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STEVEN I. WEISBURD
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP
1177 AVENUE OF THE AMERICAS
41 ST FLOOR
NEW YORK, NY 10036-2714

EXAMINER	
PARSONS, THOMAS H	
ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 06/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/996,669	HAYASHI ET AL.
	Examiner	Art Unit
	Thomas H Parsons	1745

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Peri d f r Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 November 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s)_____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19,21-24,26 and 27* is/are rejected.

7)☒ Claim(s) *20 and 25* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 November 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Drawings

1. The drawings are objected to because the x and y axis in Figure 20 have not been labeled. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because of the following informalities:

Page 4, line 18, suggest changing "punch 124" to --punch 124--;

Page 7, line 19, suggest changing "exhibits" to --exhibit--;

Page 9, line 15, suggest changing "sharing" to --shearing--;

Page 11, line 14, suggest changing "gram" to --graph--;

Page 13, line 18, suggest changing "sharing" to --shearing--;

Page 17, lines 11 and 14, suggest changing "sharing" to --shearing--;

Page 16, line 7, suggest deleting "in";

Page 19, lines 14 and 15, suggest changing "sharing" to --shearing--;

Page 20, line 11, suggest deleting the second occurrence of "is"; and,

Line 14, suggest changing "sharing" to --shearing--;

Page 21, line 11, suggest changing "sharing" to --shearing--;

Page 22, line 12, suggest changing "flew" to --flow-- and;

Line 16, "radio" to --ratio--; and,

Line 21, the text, "materials fallen within the ..." appears awkwardly worded;

Page 23, line 2, suggest changing "sharing" to --shearing--; and,

Line 13, suggest deleting "fallen";

Page 27, line 5, before "plotted", suggest inserting --in Figure 11--;

Page 30, lines 7, 13, and 17, suggest changing "share" to --shear--;

Page 31, line 4, suggest deleting "fallen";

Page 33, line 10, suggest changing "bubble" to --circle--;

Page 34, line 5, suggest deleting "fallen";

Page 36, line 9, suggest changing "staring" to --starting--

Page 37, line 22, suggest changing "Figure 14" to --Figure 15--;

Page 39, line 17, suggest changing "sharing" to --shearing--;

Page 42, line 13, suggest changing "he" to --the--;

Page 43, line 15, suggest changing "flew" to --applied an--;

Page 46, line 3, suggest changing "sharing" to --shearing--; and,

Line 7, suggest deleting "fallen";

Page 47, line 5, suggest defining the acronym "EBSP";

Page 49, line 21, suggest changing "Bubbles" to --circles--; and,

Page 50, last line, the text, "Since the p-type/n-type thermoelectric...is surely reduced." appears awkwardly worded.

Appropriate correction is required.

Claim Objections

3. Claim 4 is objected to because of the following informalities:

Claim 4, Line 12, suggest changing "sharing" to --shearing--; and

Claim 23, line 11, suggest changing "sharing" to --shearing--.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claim 4-19, 1-3, 21-22, 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. (6,313,392), and further in view of Applicants' Prior Art Figure 2.

Claim 4: Sato et al. in Figure 14 disclose a process for producing a thermoelectric material composed of at least one element selected from the group consisting of Bi and Sb and at least one element selected from the group consisting of Te and Se (col. 36: 21-26), comprising the steps of: a) preparing a fusion of said thermoelectric material; b) rapidly solidifying said fusion so as to obtain flakes of said thermoelectric material, c) stacking said flakes so as to form a lamination; d) putting said lamination into a die unit having an inlet

portion and an outlet portion; and e) pressurizing said lamination for extruding a bulk of said thermoelectric material from said die unit at least once (col. 21: 36-col. 24: 23).

Sato et al. do not disclose that the die has an inlet portion and an outlet portion obliquely extending with respect to said inlet portion; and e) pressurizing said lamination for extruding a bulk of said thermoelectric material from said die unit at least once so that a sharing force is exerted on said lamination at a boundary between said inlet portion and said outlet portion.

The Applicants' Prior Art Figure 2 discloses a die having an inlet portion and an outlet portion obliquely extending with respect to said inlet portion; and e) pressurizing said lamination for extruding a bulk of said thermoelectric material from said die unit at least once so that a sharing force is exerted on said lamination

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the die of Sato et al. with the die inlet and outlet of the Applicants' prior Art Figure 2 because the Applicants teach a die that would have controlled crystal growth, reduced electrical resistivity and thermal conductivity thereby improving the figure of merit of the thermoelectric materials and the overall device.

Claim 5: The Sato et al. combination does not disclose an angle between said inlet portion and said outlet portion ranges from 30 degrees to 150 degrees.

The Applicants' Prior Art Figure 2 discloses an angle between said inlet portion wherein said outlet portion ranges from 30 degrees to 150 degrees (specifically 90 degrees).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the inlet and outlet of Sato et al. with inlet and outlet angle of the Applicants' prior Art Figure 2 for reasons as set for the above in claim 4.

Claim 6: The rejection of claim of claim 6 is as set forth above wherein the Applicant Prior Figure 2 specifically discloses 90 degrees.

Claim 7: Sato et al. disclose that lamination is heated to 300-600 degrees in centigrade in said step e) (col. 25: 28-55).

Claim 8: Sato et al. disclose that that lamination is heated to 320-450 degrees in centigrade in said step e) (col. 25: 28-55).

Claim 9: Sato et al. disclose that lamination is heated to 300-600 degrees in centigrade. As to the recitation "an angle between said inlet portion and said outlet portion ranges from 30 degrees to 150 degrees", the rejection is as set forth above in claim 5.

Claim 10: Sato et al. disclose that lamination is heated to 320-450 degrees in centigrade (col. 25: 28-55). As to the recitation "an angle between said inlet portion and said outlet portion ranges from 30 degrees to 150 degrees", the rejection is as set forth above in claim 5.

Claim 11: Sato et al. disclose that thermoelectric material has a ratio of Te to Se fallen within the range between 2.5/0.5 and 2.7/0.3 (col. 36: 22-30; and col. 15: 26-31).

Claim 12: As to the recitations "said thermoelectric material has a ratio of Te to Se fallen within the range between 2.5/0.5 and 2.7/0.3", the rejection is as set forth above in claim 11, "an angle between said inlet portion and said outlet portion ranges from 30 degrees to 150 degrees", the rejection is as set forth above in claim 5, and "said lamination is heated to 300-600 degrees in centigrade", the rejection is as set forth above in claim 9.

Claim 13: As to the recitations, "said thermoelectric material has a ratio of Te to Se fallen within the range between 2.5/0.5 and 2.7/0.3", the rejection is as set forth above in claim 11, and "an angle between said inlet portion and said outlet portion ranges from 90 degrees

to 120 degrees", the rejection is as set forth above in claim 12, and "said lamination is heated to 320-450 degrees in centigrade", the rejection is as set forth above in claim 10.

Claim 14: Sato et al. disclose a cross sectional area of said inlet portion is at least 4.5 times wider than an across sectional area of said outlet portion (col. 25: 53-54; and col. 38: 15-21).

Claim 15: Sato et al. disclose a cross sectional area of said inlet portion is at least 4.5 times wider than an across sectional area of said outlet portion (col. 25: 53-54; and col. 38: 15-21). As to the recitations "said thermoelectric material has a ratio of Te to Se fallen within the range between 2.5/0.5 and 2.7/0.3, the rejection is as set forth above in claim 11, and "an angle between said inlet portion and said outlet portion ranges from 30 degrees to 150 degrees", the rejection is s set forth above in claim 5, and "said lamination is heated to 300-600 degrees in centigrade", the rejection is as set forth above in claim 11.

Claim 16: Sato et al. disclose a cross sectional area of said inlet portion is at least 4.5 times wider than an across sectional area of said outlet portion (col. 25: 53-54; and col. 38: 15-21). As to the recitations "said outlet portion, said thermoelectric material has a ratio of Te to Se fallen within the range between 2.5/0.5 and 2.7/0.3, the rejection is as set forth above in claim 11, "an angle between said inlet portion and said outlet portion ranges from 90 degrees to 120 degrees", the rejection is s set forth above in claim 6, and "said lamination is heated to 320-450 degrees in centigrade", the rejection is as set forth above in claim 8.

Claim 17: Sato et al. that the bulk of said thermoelectric material is extruded from said die unit at 0.01-1 mm/min in said step e)(col. 25: 29-31 and 55 which discloses .5 mm/min.

Claim 18: The Sato et al. combination does not disclose that said bulk of said thermoelectric material is extruded from said die unit at 0.05-0.2 mm/min. However, Sato et al. disclose on col. 27:36-65 that the extrusion speed can be changed by controlling the degree of opening of a flow rate control valve. Therefore, it would have been within the skill of one having ordinary skill in the art at the time the invention was made to have modified the process of the Sato et al. combination to provide the claimed extrusion rate in light of the teaching of Sato et al. because Sato et al. teach an extrusion step that would have provide a means for controlling the extrusion rate thereby improving the overall efficiency of the method.

Claim 19: the Sato et al. combination does not disclose that steps d) and e) are repeated at least once. However, the repetition of the steps to provide the same results is within the skill of one having ordinary skill in the art. The concept of duplication is not patentable. St. Regis Paper Co. v. Bemis Co. Inc., 193 USPQ 8, 11 (7th Cir. 1977). While this decision relates to the duplication of parts, there is not reason why such duplication cannot be extended to a process step.

Claim 22: As to the recitation "pressurizing said bulk of said thermoelectric material in a direction perpendicular to a centerline of said outlet portion on a virtual plane defined by said centerline and a centerline of said inlet portion for a hot pressing", it would have been obvious to one of ordinary skill in the art at the time the invention that the Sato et al. combination would provide the claimed pressurizing as the die of the Sato et al. combination is the same as that instantly disclosed.

Claim 1: The rejection of claim 1 is as set forth above in claim 4: As to the recitation, "crystal grains having respective [001] directions and an average grain size equal to or less than 30 microns, certain crystal grains having the [001] directions crossing a direction in which an electric current flows at 45 degrees or less, said certain crystal grains occupying an area equal to or less than 10% on a section perpendicular to said direction", it would have been obvious to one of ordinary skill in the art at the time the invention was made to have expected the material of the Sato et al. combination to provide the claimed crystal grain as the thermoelectric material of the Sato et al. combination is the same in composition and in the manner in which it is produce to what is instantly disclosed.

Claim 2: Sato et al. disclose that the thermoelectric material contains at least one element selected from the group
consisting of I, Cl, Hg, Br, Ag and Cu (col. 25: 22-31 which discloses $HgBr_3$.

Claim 3: Although the Sato et al. combination does not disclose that the electron serves as the major carrier therein, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have expected the thermoelectric material of the Sato et al. combination to provide the claimed "major carrier" for reasons as set forth above in claim 1.

Claim 26: Sato et al. disclose in Figure 29 a thermoelectric module for producing a temperature difference from an electric current passing therethrough, comprising: a pair of substrates having respective inner surfaces opposite to each other; conductive layers (electrodes 130) formed on said inner surfaces; and plural thermoelectric elements (120) of a first conductivity type (n-type) and other thermoelectric elements (110) of a second conductivity (p-type) type held in contact with said conductive layers so as to be alternately connected in series,

each of the thermoelectric elements consisting of said plural thermoelectric elements and said other thermoelectric elements including a piece of thermoelectric material and metal layers, said piece of thermoelectric material being composed of at least one element selected from the group consisting of Bi and Sb and at least one element selected from the group consisting of Te and Se, said piece of thermoelectric material (col. 2:38-51).

As to the recitation "crystal grains having respective [001] directions and an average grain size equal to or less than 30 microns, certain crystal grains having the [001] directions crossing a direction in which an electric current flows at 45 degrees or less, said certain crystal grains occupying an area equal to or less than 10% on a section perpendicular to said direction", the rejection of claims 1 and 4 are as applied, argued and disclosed above, and incorporated herein.

Claim 27: Sato et al. disclose that the thermoelectric material contains at least one element selected from the group consisting of Hg and Br (col. 25: 22).

6. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al. and further in view of Applicants' Prior Art Figure 2 as applied to claim 4 above, and further in view of Fukuda et al.

The rejection of Claim 4 is as applied, argued, and disclosed above, and incorporated herein wherein, further, Sato et al. disclose on col. 20:27-37 that sintering and extrusion can be performed concurrently but do not disclose sintering the bulk of the thermoelectric material with the assistance of plasma in inert atmosphere.

Fukuda at al. disclose in col. 12: 40-43 sintering the bulk of the thermoelectric material with the assistance of plasma in inert atmosphere.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the sintering of the Sato et al. combination with the sintering conditions of Fukuda et al. because Fukuda et al. teach sintering that would have produced crystal grain alignment thereby improving the figure of merit and the overall performance of thermoelectric devices.

7. Claims 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuda et al. (6,274,802), and further in view of Applicants' Prior Art Figure 2.

Claim 23: Fukuda et al. in Figure 4 discloses a process for producing a thermoelectric material composed of at least one element selected from the group consisting of Bi and Sb and at least one element selected from the group consisting of Te and Se, comprising the steps of: a) preparing one of an ingot of said thermoelectric material and a powder of said thermoelectric material; b) putting said one of said ingot and said powder into a die; and c) pressurizing said one of said ingot and said powder for extruding a bulk of said thermoelectric material from said die unit at least once (col. 12: 27-47).

Fukuda et al. do not disclose a die having an inlet portion and an outlet portion obliquely extending with respect to said inlet portion; and so that a sharing force is exerted on said one of said ingot and said powder at a boundary between said inlet portion and said outlet portion.

The Applicants' Prior Art Figure 2 discloses a die having an inlet portion and an outlet portion obliquely extending with respect to said inlet portion; and so that a sharing force is

exerted on said one of said ingot and said powder at a boundary between said inlet portion and said outlet portion.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have substituted the die of Sato et al. with the die of the Applicants' prior Art Figure 2 because the Applicants teach a die that would have controlled crystal growth, reduced electrical resistivity and thermal conductivity thereby improving the figure of merit of the thermoelectric materials and the overall device.

Claim 24: Fukuda et al. disclose in Figure 4 steps of d) reducing the powder in hydrogen atmosphere between step a) and step b), and e) sintering the powder between step d) and step b) for solidifying the powder (col. 12: 27-47).

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

JP2002-248517 published 3 September 2002 discloses a die having an inlet portion and an outlet portion obliquely extending with respect to the inlet portion, and a method of using the same wherein a pressure is applied in a direction opposite the extruding direction.

Allowable Subject Matter

9. Claims 20 and 25 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas H Parsons whose telephone number is (703) 306-9072. The examiner can normally be reached on M-F (7:00-4:30) First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on (703) 308-2383. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Thomas H Parsons
Examiner
Art Unit 1745

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June 10, 2003

Patrick Ryan
Supervisory Patent Examiner
Technology Center 1700